

REMARKS

Claims 1 through 48 were pending in the application when an Office Action was mailed December 24, 2003, with respect to the above-identified application. The Office Action indicated that the Claims 1-3, 6-8, 11-14, 17-19, 22-25, 28-30, 33-36, and 39-45 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,884,772 to Kraft ("Kraft"). In addition, Claims 1-45 and 47-48 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,685,643 to Henderson et al. ("Henderson et al."). Lastly, Claim 46 was rejected under 35 U.S.C. § 103(a) as being unpatentable over either Henderson et al. or Kraft. The Office Action was not made final.

Applicant has amended independent Claims 1, 6, 12, 17, 23, 28, 34, and 39 to further differentiate these Claims and Claims depending from them from the applied references. Further, based on the following response, Applicant respectfully requests reconsideration and allowance of Claims 1-48.

Rejections Under 35 U.S.C. § 102(b)

Under 35 U.S.C. § 102(b), Claims 1-3, 6-8, 11-14, 17-19, 22-25, 28-30, 33-36, and 39-45 were rejected as being anticipated by Kraft. More particularly, these Claims were rejected because "Kraft (4884772) shows a mounting base 35, since it is sized to be effective in a particular position on the engine to form a vortex over the wing than it is sized as functionally claimed in the application" (Office Action, page 2). Under 35 U.S.C. § 102(b), Claims 1-45 and 47-48 were rejected as being anticipated by Henderson et al. More particularly, these Claims were rejected because "Henderson et al (4685643) shows a leading edge flap on the wing in the area of the engine the chine 60 is mounted on the nacelle, therefore it has a 'mounting base'. Since the chine is sized to be effective in a particular position on the engine to form a vortex over the wing than it is sized as functionally claimed in the application" (Office Action, page 2). Applicant respectfully traverses.

Applicant respectfully submits that each of the rejected Claims are patentable because each includes at least one element that is neither taught nor suggested by the applied references. More particularly, each independent claim as amended, and therefore each claim depending therefrom, includes a nacelle chine disposed on an "outboard" surface of an engine nacelle "adjacent a rearward swept portion of the wing." The applied references not only do not disclose an "outboard" placement of the nacelle chine, but teach away from using an outboard placement of the nacelle chine. Accordingly, the claimed invention is not anticipated by either Kraft or Henderson et al.

With regard to the purpose and configuration of the vortex control device, Kraft targets a different objective than drag reduction, a principal object of the present invention. Kraft, by contrast, targets an entirely different purpose:

"Devices to lower the stall speed of aircraft to thereby improve aircraft aerodynamic performance are known in the art. For example, vortex control devices which have been mounted to aircraft engine nacelles to aerodynamically interact with airflow around the wing have been used to lower aircraft stall speed, thereby enabling lower landing speeds and safer short field operations. U.S. Pat. No. 4,540,143 to Wang et al., commonly assigned with the present invention and incorporated by reference herein, describes one such wake or vortex control device. This device is mounted to the exterior surface of an aircraft engine nacelle below and forward of the leading edge of the wing. The wake control device generates a vortex which sweeps back and over the top of the wing to control air flow, resulting in a lower aircraft stall speed which enables lower landing speeds and thereby increases the safety and short field performance of the aircraft."

Kraft, Column 1, Lines 22-39 (emphasis added). Furthermore, Kraft does not describe where the vortex control device is to be placed, and the word "outboard" nowhere appears in the reference.

Although Kraft does not describe on which side the vortex control device is to be placed, as quoted above, Kraft references U.S. Patent No. 4,540, 143 to Wang et al. ("Wang et al."). Wang et al. specifically teaches placing the vortex control device on the inboard side of the nacelle:

"Because of the wing sweep and presence of the nacelle strut, the wing leading edge suction always peaks just inboard of the pylon 32. This suction peak

increases with the angle of attack so that at high angles, it pulls the nacelle wake 40 and boundary layer which has already been thickened with low energy air from the nacelle boundary layer. The resulting interaction of nacelle and wing flow induces flow separation and stalling of the inboard wing. This flow phenomena is best illustrated in FIG. 2, and it can be seen that the inboard edge portion 42 of the turbulent wake 40 slants in an expanding pattern in an inboard direction toward the trailing edge 28. The separated flow region is indicated generally by the more darkly shaded area 43 in FIG. 3. This reduces the lift which could otherwise be achieved. To describe the principle of the present invention, reference is now made to FIGS. 4, 5 and 6 where there is shown the nacelle/wing assembly such as that described above, having the flow pattern described above with reference to FIGS. 1 through 3. The present invention is based upon the finding that the turbulent wake problem indicated above can be substantially reduced by placing a nacelle wake control device 46 at the nacelle upper side surface that is adjacent the forward swept portion of the wing 24. (For ease of description, since the forward swept portion of the wing is the portion of the wing inboard of the nacelle 12, the location of the device 46 will be referred to as being at an inboard location, it being understood that if the wing 24 were swept in the opposite direction, the device 46 would be on the outboard side of the nacelle 12.)

* * *

To describe the principle of the present invention, reference is now made to FIGS. 4, 5 and 6 where there is shown the nacelle/wing assembly such as that described above, having the flow pattern described above with reference to FIGS. 1 through 3. The present invention is based upon the finding that the turbulent wake problem indicated above can be substantially reduced by placing a nacelle wake control device 46 at the nacelle upper side surface that is adjacent the forward swept portion of the wing 24. (For ease of description, since the forward swept portion of the wing is the portion of the wing inboard of the nacelle 12, the location of the device 46 will be referred to as being at an inboard location, it being understood that if the wing 24 were swept in the opposite direction, the device 46 would be on the outboard side of the nacelle 12.)”

Wang et al. Column 5, Line 24, through Column 6, Line 16 (emphasis added). Therefore, it is clear that Wang et al. teaches placement of a vortex control device on the inboard side of the engine nacelle on the side adjacent the forward swept portion of the wing. Accordingly, even by reference, Kraft not only neither teaches nor discloses the claimed invention, but diametrically teaches away from the claimed invention.

Similarly, Henderson et al. teaches away from the claimed invention. Henderson et al. describes placing a wake control device on the inboard side of the engine nacelle because, as Henderson et al. describes it, any wake on the outboard side of the engine nacelle is unimportant:

“As indicated previously, the flow upwardly over the outboard side of the nacelle is less critical. This outboard airflow 40 upwardly around the nacelle results in a vortex, indicated at 42 generated at the outboard location of the pylon. In the illustrations of FIGS. 1 through 3, this vortex 42 is shown as passing over the leading edge 26 and passes above the flow field immediately adjacent the wing. There is also shown a lower vortex 44 which passes beneath the wing on the outboard side of the nacelle 12. Generally, neither of these vortices 42 and 44 have any substantial degrading effect on wing performance.

However, there is more of a problem with the vortex 46 which can be called a "critical vortex" and which is forced to exist on the inboard side of the nacelle 12. As illustrated in FIG. 1, this vortex 46 forms in the intense upwash field near the wing leading edge 26 adjacent the inboard nacelle separation line at the nacelle pylon intersection, indicated at 48. This vortex 46 is "captured" in the low pressure field that exists at the wing leading edge 26 on the inboard side of the pylon 32 and attaches itself to the wing upper surface 30. If the vortex were to remain intact as it passes over the wing upper surface 30 (i.e. if the vortex 46 were not to burst), then it might assume a configuration as generally illustrated in FIGS. 1 through 3. The vortex would expand in an inboard direction, as indicated at 50 and finally pass over the trailing edge of the wing in the general area indicated at 52.”

Henderson et al., Column 6, Lines 18-46 (emphasis added). Thus, Henderson et al. also teaches away from placing a vortex control device on an outboard side of the engine nacelle.

By contrast, the claimed invention specifically places the nacelle chine on the outboard side of the engine nacelle toward the rearward swept side of the wing, as clarified by the present amendment. Independent Claims 1, 6, 12, 17, 23, 28, 34, and 39, as amended, specifically claim that the chine is placed on an “outboard” side of the engine nacelle “adjacent a rearward swept portion of the wing.” The applied references neither teach nor suggest such an element, therefore, Claims 1, 6, 12, 17, 23, 28, 34, and 39 are not anticipated by the applied references. Moreover, because Claims 2-5, 7-11, 13-16, 18-22, 24-27, 29-33, 35-38, and 40-48 depend from these Claims, these dependent claims also are not anticipated by the applied references.

Accordingly, Applicant respectfully requests entry of the present amendment and allowance of Claims 1-48.

In sum, Applicant asks the Examiner to find that Claims 1-4, 7, 14, and 17-20 are novel and patentable over the applied reference.

Rejections Under 35 U.S.C. § 103(a)

Claim 46 was rejected under 35 U.S.C. § 103(a) as being unpatentable over either Henderson et al. or Kraft. Applicant respectfully traverses.

Claim 46 depends from and adds additional limitations to Claim 39 which, for reasons previously described, Applicant respectfully submits is now allowable. Accordingly, Applicant respectfully requests reconsideration and allowance of Claim 46.

CONCLUSION

In view of the above amendments and remarks, Applicant very respectfully submits that Claims 1-48 are patentable over the cited references and are in condition for allowance. Applicant very respectfully requests entry of the Amendment, and reconsideration and allowance of all claims.

Respectfully submitted,

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MAIL CERTIFICATE

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4/14/04

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